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(54) MOBILE ULTRASOUND DIAGNOSIS SYSTEM USING TWO-DIMENSIONAL ARRAY DATA AND MOBILE ULTRASOUND DIAGNOSIS PROBE DEVICE AND ULTRASOUND DIAGNOSIS APPARATUS FOR THE SYSTEM

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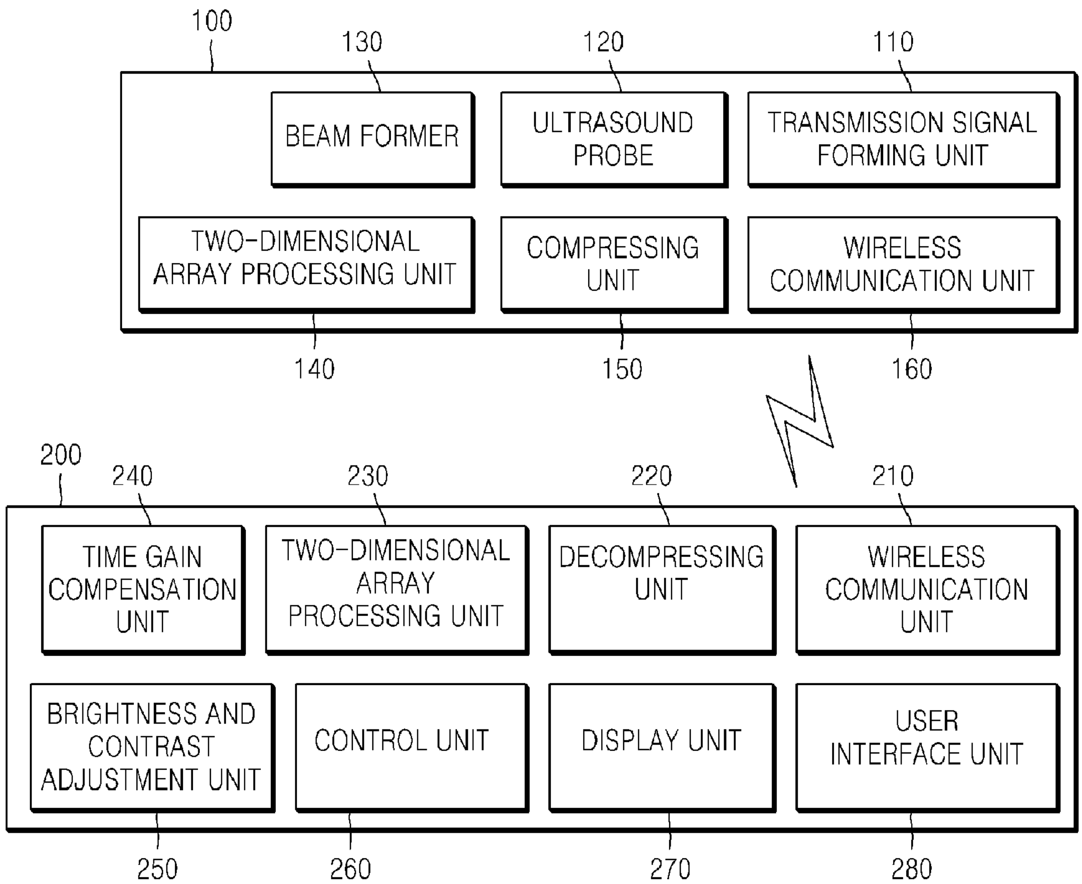
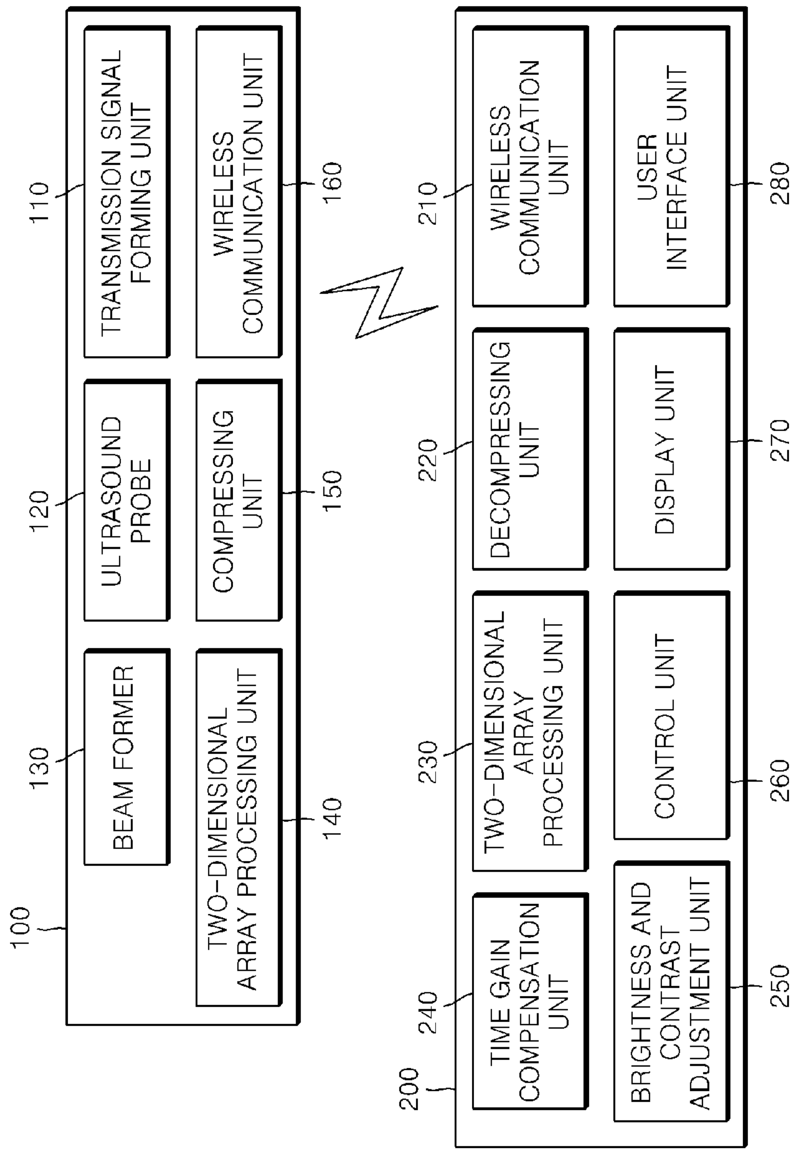
(57) **ABSTRACT**

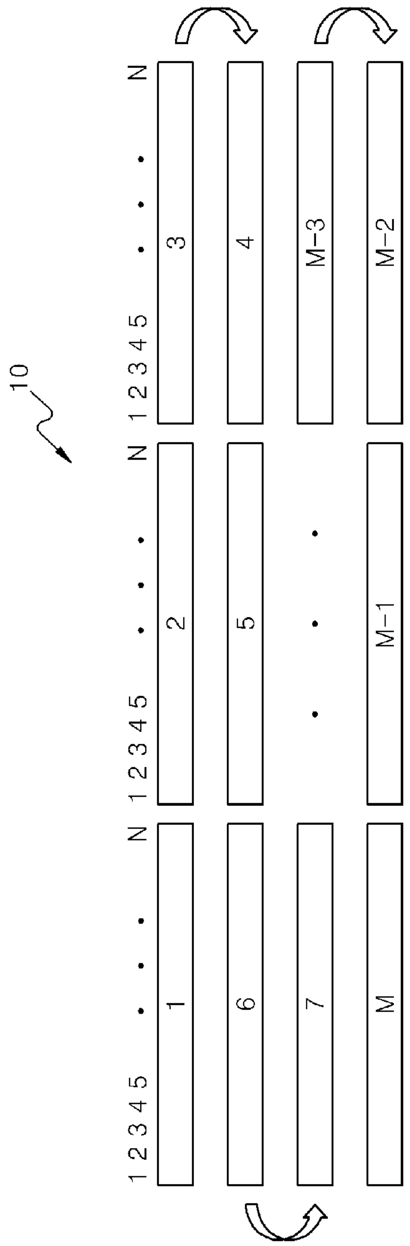
Provided is a mobile ultrasound diagnosis system including a mobile ultrasound diagnosis probe device, being portable, digitally processing ultrasonic data obtained from an object, processing digitalized ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame, and wirelessly transmitting the two-dimensional array ultrasonic data and an ultrasound diagnosis apparatus receiving the two-dimensional array ultrasonic data from the mobile ultrasound diagnosis probe device, decompressing and restoring the two-dimensional array ultrasonic data, and generating ultrasonic image data by compensating a time gain and adjusting brightness and a contrast of the two-dimensional array ultrasonic data.



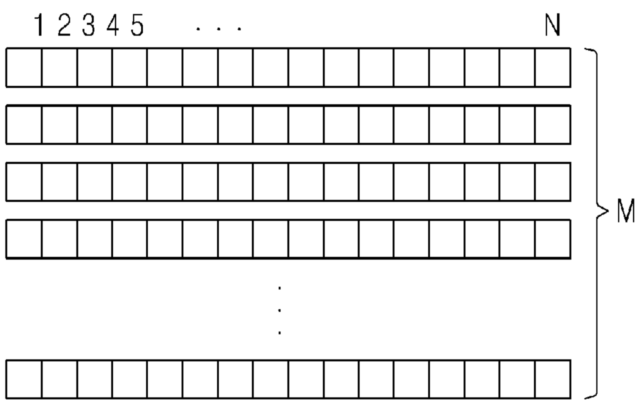
[Fig. 1]


100
110
TRANSMISSION SIGNAL FORMING UNIT
120
ULTRASOUND PROBE
130
BEAM FORMER
140
TWO-DIMENSIONAL ARRAY PROCESSING UNIT
150
COMPRESSING UNIT
160
WIRELESS COMMUNICATION UNIT
200
210
WIRELESS COMMUNICATION UNIT
220
DECOMPRESSING UNIT
230
TWO-DIMENSIONAL ARRAY PROCESSING UNIT
240
TIME GAIN COMPENSATION UNIT
250
BRIGHTNESS AND CONTRAST ADJUSTMENT UNIT
260
CONTROL UNIT
270
DISPLAY UNIT
280
USER INTERFACE UNIT

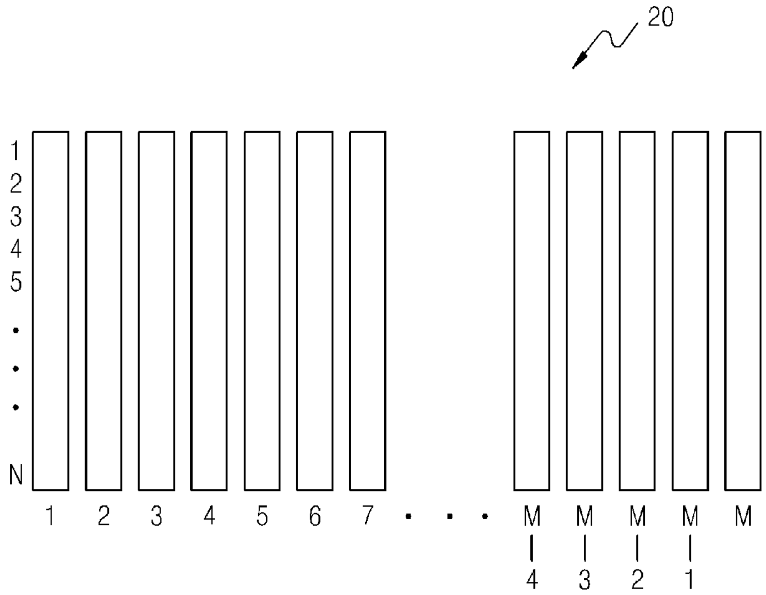
[Fig. 2]



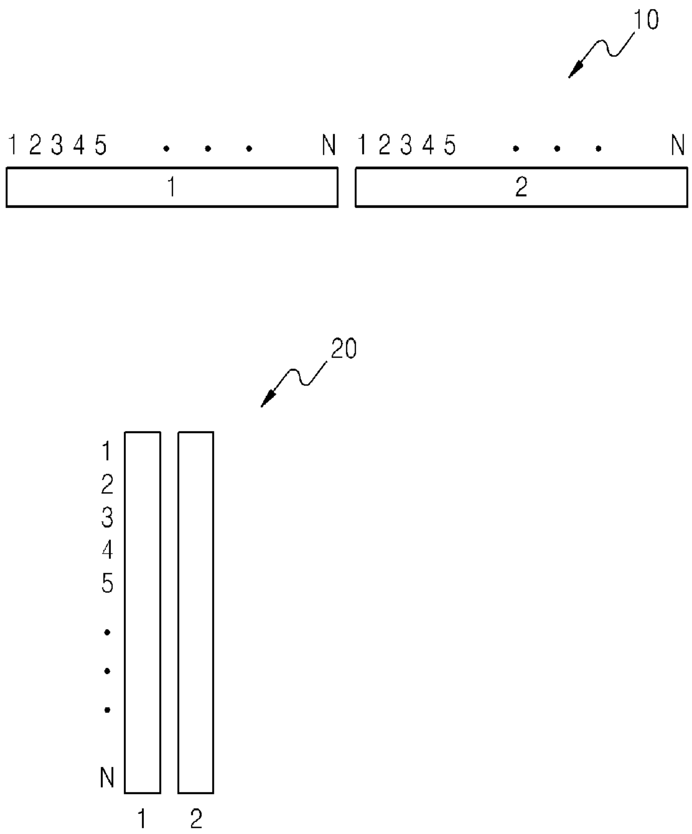
[Fig. 3]



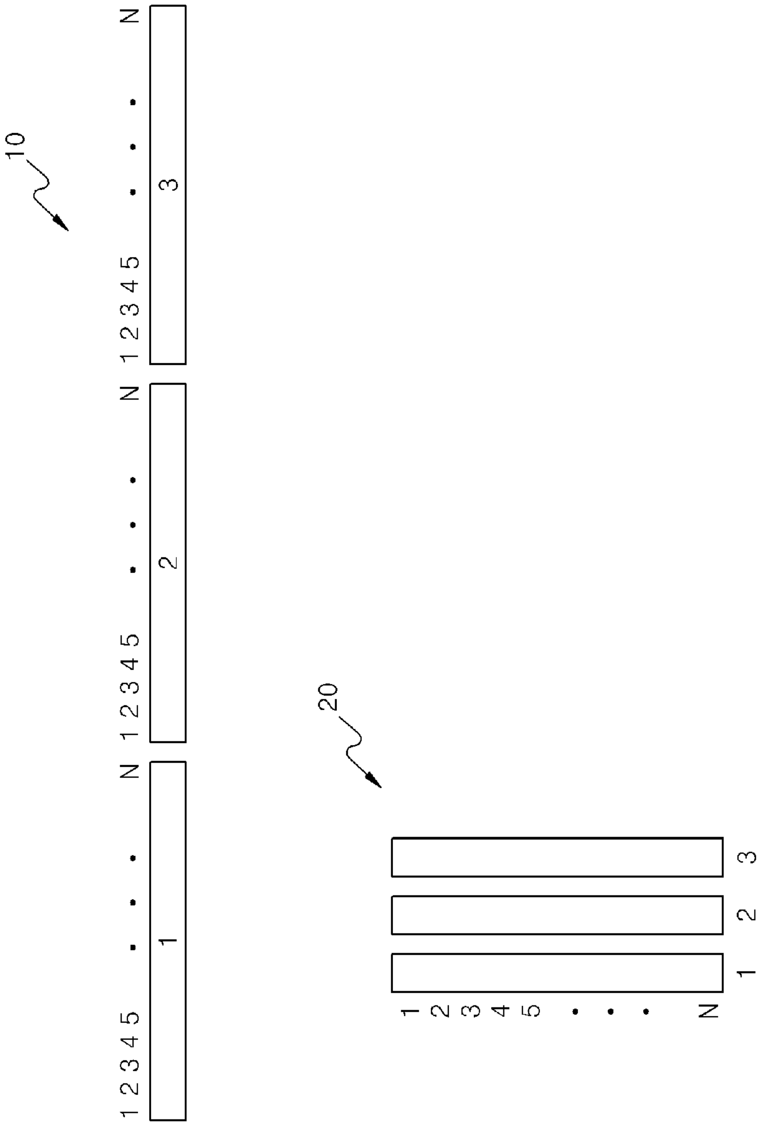
[Fig. 4]


20
1
2
3
4
5
N
1 2 3 4 5 6 7 M-4 M-3 M-2 M-1 M

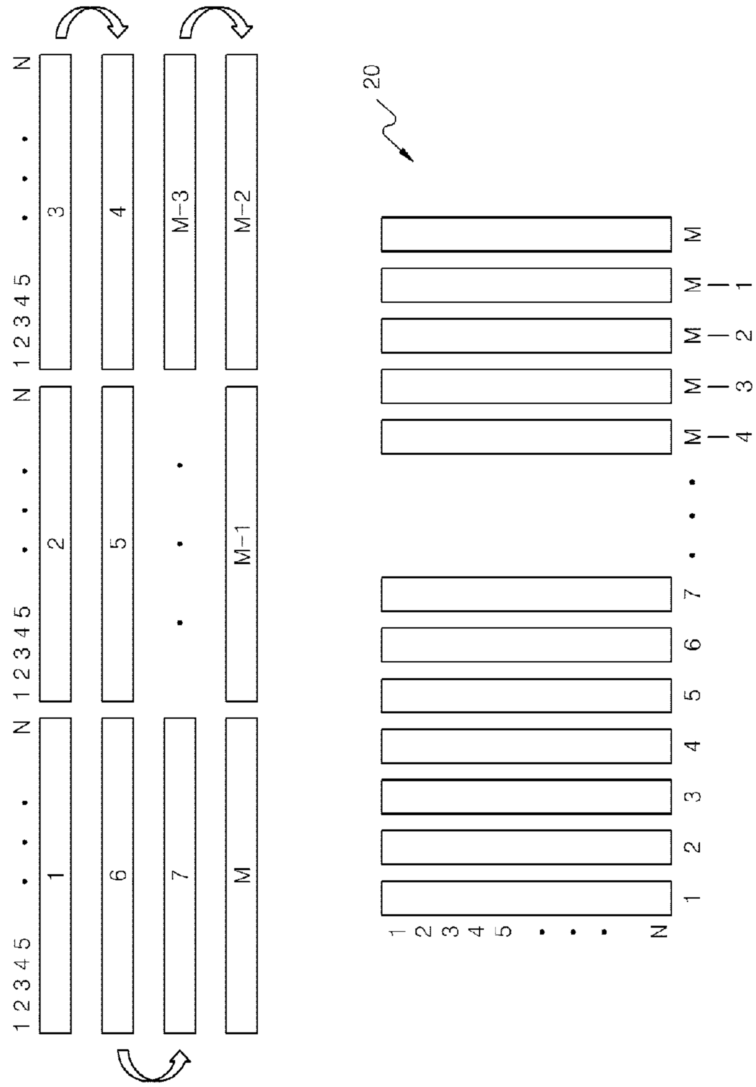
[Fig. 5]


10
1 2 3 4 5 N 1 2 3 4 5 N
1
2
20
1
2
3
4
5
N
1 2

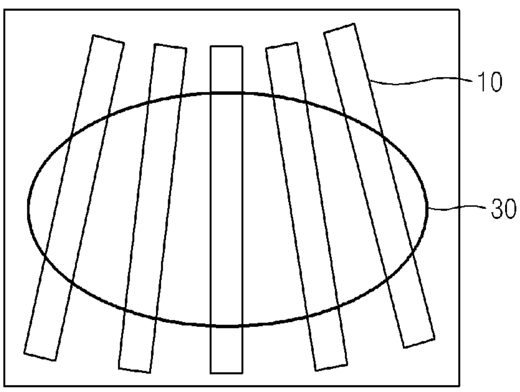
[Fig. 6]



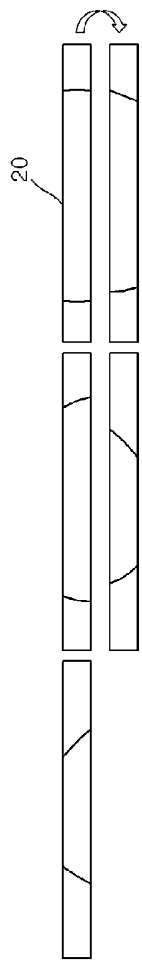
[Fig. 7]



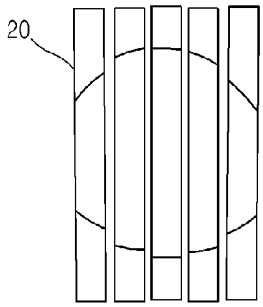
[Fig. 8]



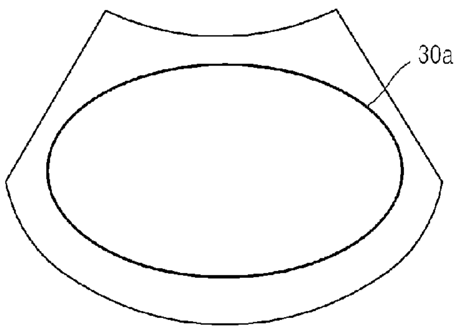
[Fig. 9]



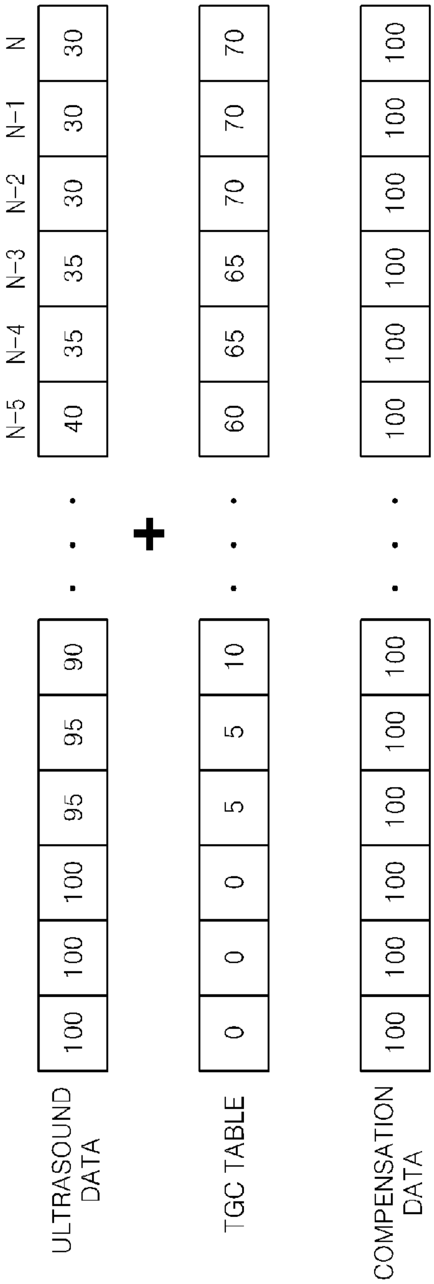
[Fig. 10]



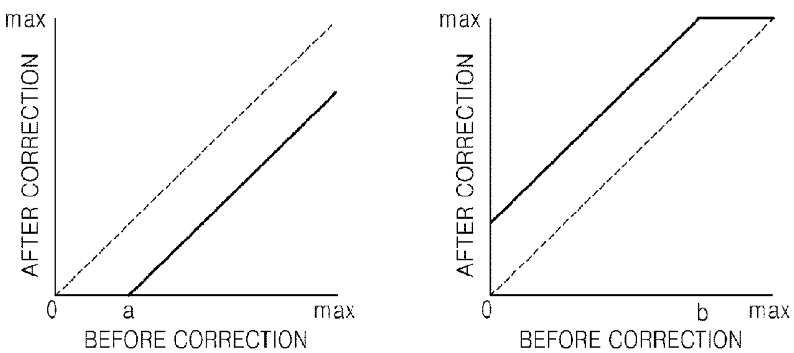
[Fig. 11]



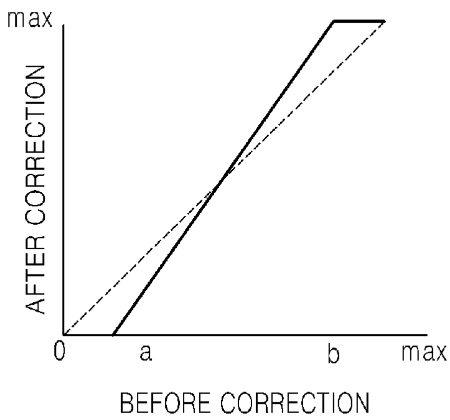
[Fig. 12]


N
N−1
N−2
N−3
N−4
N−5
30
30
30
35
35
40
70
70
70
65
65
60
100
100
100
100
100
100
+
90
95
95
100
100
100
10
5
5
0
0
0
100
100
100
100
100
100
ULTRASOUND DATA
TGC TABLE
COMPENSATION DATA

[Fig. 13]


max
AFTER CORRECTION
0
a
max
BEFORE CORRECTION
max
AFTER CORRECTION
0
b
max
BEFORE CORRECTION

[Fig. 14]



MOBILE ULTRASOUND DIAGNOSIS SYSTEM USING TWO-DIMENSIONAL ARRAY DATA AND MOBILE ULTRASOUND DIAGNOSIS PROBE DEVICE AND ULTRASOUND DIAGNOSIS APPARATUS FOR THE SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to a mobile ultrasound diagnosis system, and more particularly, to a mobile ultrasound diagnosis system processing obtained ultrasonic data into two-dimensional array data to be compressed and wirelessly transmitting the two-dimensional array data to perform ultrasound diagnosis and a mobile ultrasound diagnosis probe device and an ultrasound diagnosis apparatus for the mobile ultrasound diagnosis system.

BACKGROUND ART

[0002] Since having noninvasive and nondestructive properties, ultrasound diagnosis systems are generally used in the medical field to obtain information of the inside of an object. Since high-resolution images of internal organizations of objects may be provided to doctors with no surgical operations of directly incising and observing objects , ultrasound diagnosis systems are very importantly used in the medical field.

[0003] Generally, an ultrasound system includes an ultrasound probe, a beam former, a data processor, a scan converter, and a display unit. The ultrasound probe transmits an ultrasonic signal to an object and forms a received signal by receiving a reflected ultrasonic signal, that is, an ultrasonic echo signal. The ultrasound probe includes at least one transducer element operating to convert an ultrasonic signal and an electric signal into one another. The beam former analog/digital-converts the received signal provided from the ultrasound probe, delays a time of a digital signal considering a position and a focusing point of each conversion element, and forms ultrasonic data, that is, radio frequency (RF) data by summing up the time-delayed digital signals. The data processor performs various data processes with respect to ultrasonic data, which are necessary for forming an ultrasonic image. The scan converter scan-converts the processed ultrasonic data to be displayed on a display area of the display unit. The display unit displays the scan-converted ultrasonic data as an ultrasonic image on a screen.

[0004] Typically, data processing such as a time gain compensation (TGC) process, a plurality of finite impulse response (FIR) filtering processes, a plurality of decimation processes, an in-phase/quadrature-phase (I/Q) data forming process, and a compression process and a scan conversion are sequentially performed. Due thereto, not only a lot of time is consumed to process a large amount of ultrasonic data but also a frame rate is deteriorated.

DISCLOSURE OF INVENTION

Technical Problem

[0005] The present invention provides a mobile ultrasound diagnosis system processing ultrasound data obtained from an object into two-dimensional array data to be compressed and wirelessly transmitting the two-dimensional array data to perform ultrasound diagnosis and a mobile ultrasound diagnosis probe device and an ultrasound diagnosis apparatus for the mobile ultrasound diagnosis system.

Solution to Problem

[0006] According to an aspect of the present invention, there is provided a 1. A mobile ultrasound diagnosis system including a mobile ultrasound diagnosis probe device, being portable, digitally processing ultrasonic data obtained from an object, processing digitalized ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame, and wirelessly transmitting the two-dimensional array ultrasonic data and an ultrasound diagnosis apparatus receiving the two-dimensional array ultrasonic data from the mobile ultrasound diagnosis probe device, decompressing and restoring the two-dimensional array ultrasonic data, and generating ultrasonic image data by compensating a time gain and adjusting brightness and a contrast of the two-dimensional array ultrasonic data.

[0007] The mobile ultrasound diagnosis probe device may process reception ultrasonic frames of a series stream into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame unit to be perpendicular.

[0008] The ultrasound diagnosis apparatus may determine an ultrasonic wave measurement depth according to an input of a user and may determine a parameter for compensating a time gain and parameters for adjusting the brightness and the contrast, based on the ultrasonic wave measurement depth.

[0009] The ultrasound diagnosis apparatus may transmit dummy data for automatically measuring a wireless communication environment and determining sizes of transmission data to the mobile ultrasound diagnosis probe device. Also, the mobile ultrasound diagnosis probe device may receive the dummy data from the ultrasound diagnosis apparatus, may calculate an available band of presently used wireless communication by measuring an amount of time for receiving the dummy data, and may determine sizes of data to be wirelessly transmitted according to the available band.

[0010] According to another aspect of the present invention, there is provided a mobile ultrasound diagnosis probe device including a transmission signal forming unit forming a transmission signal for obtaining a frame of an ultrasonic image, an ultrasound probe converting the transmission signal of the transmission signal forming unit into an ultrasonic signal, transmitting the ultrasonic signal to an object, and obtaining analog ultrasonic data reflected from the object, a two-dimensional array processing unit processing the obtained analog ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame, a compressing unit compressing the two-dimensional array ultrasonic data adjacently arranged for each ultrasonic frame, and a wireless communication unit wirelessly transmitting compressed two-dimensional array ultrasonic data to an ultrasound diagnosis apparatus.

[0011] The two-dimensional array processing unit may process reception ultrasonic frames of a series stream into two-dimensional array ultrasonic data by adjacently arranging for each frame unit to be perpendicular.

[0012] The mobile ultrasound diagnosis probe device may further include a beam former generating digitalized ultrasonic data from the analog ultrasonic data obtained from the ultrasound probe.

[0013] The beam former may generate M number of arrays having N size in the case of using the M number of ultrasonic waves for one ultrasonic image frame and performing N times of sampling when the respective ultrasonic waves are reflected and return from the object.

[0014] The two-dimensional array processing unit may generate two-dimensional array data having N×M arrays in the case of using M number of ultrasonic waves for one ultrasonic image frame and performing N times of sampling when the respective ultrasonic waves are reflected and return from the object.

[0015] The wireless communication unit may include short-distance wireless communications by using any one of Bluetooth, wireless USB, wireless LAN, WiFi, Zigbee, and Infrared data association (IrDA).

[0016] According to still another embodiment of the present invention, there is provided an ultrasound diagnosis apparatus including a decompressing unit wirelessly receiving compressed ultrasonic data from a mobile ultrasound diagnosis probe device and decompressing the ultrasonic data by using the same method as a compression method used by the mobile ultrasound diagnosis probe device, a two-dimensional array processing unit processing the decompressed ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame, a time gain compensation unit compensating a time gain with respect to the two-dimensional array ultrasonic data, a brightness and contrast adjustment unit adjusting brightness and a contrast with respect to the two-dimensional array ultrasonic data, and a control unit generating an ultrasonic image for diagnosis by using two-dimensional array ultrasonic data having a compensated time gain and adjusted brightness and contrast.

[0017] The time gain compensation unit may compensate ultrasonic data according to a time gain compensation table.

[0018] The brightness and contrast adjustment unit may change a brightness value of a certain value or less into 0 and may change a brightness value of a certain value or more into a maximum value.

[0019] The brightness and contrast adjustment unit may change a contrast value of a certain value or less into 0 and may change a contrast value of a certain value or more into a maximum value.

Advantageous Effects of Invention

[0020] According to the present embodiment, since a processing amount of ultrasonic data may be reduced by two-dimensional data processing operation in a mobile ultrasound diagnosis probe device, it is possible to simplify programs operated in the ultrasound diagnosis apparatus and to reduce an amount of consumed source such as a memory and a central processing unit (CPU). In addition, the ultrasound diagnosis apparatus performs time gain compensation operations and brightness and contrast adjustment operations, thereby providing stability.

[0021] Also, the mobile ultrasound diagnosis probe device transmits two-dimensionally arranged ultrasonic data to the ultrasound diagnosis apparatus in such a way that the ultrasound diagnosis apparatus may apply various image processing processes by using original ultrasonic data. DR

BRIEF DESCRIPTION OF DRAWINGS

[0022] FIG. **1** is a block view illustrating a mobile ultrasound diagnosis system according to an embodiment of the present invention;

[0023] FIG. **2** is a view illustrating transmission ultrasonic frames of an ultrasonic probe according to an embodiment of the present invention;

[0024] FIG. **3** is a view illustrating ultrasonic data, when M number of ultrasonic waves are used and N times of sampling are performed, according to an embodiment of the present invention;

[0025] FIG. **4** is a view illustrating two-dimensional arrangement according to an embodiment of the present invention;

[0026] FIGS. **5** to **7** are views illustrating a two-dimensional arrangement process according to an embodiment of the present invention;

[0027] FIGS. **8** to **11** are views collectively illustrating the two-dimensional arrangement process shown in FIGS. **5** to **7**;

[0028] FIG. **12** is a view illustrating a time gain compensation operation according to an embodiment of the present invention;

[0029] FIG. **13** is a view illustrating brightness adjustment according to an embodiment of the present invention; and

[0030] FIG. **14** is a view illustrating contrast adjustment according to an embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0031] Hereinafter, the embodiments of the present invention will be described in detail with reference to the attached drawings. The following embodiments are provided as examples to fully convey the spirits of the present invention to a person skilled in the art. Accordingly, the present invention is not limited to the embodiments described below and may be embodied in other forms. Also, in the drawings, a width, a length, and a thickness of an element may be exaggerated for convenience of description. Like reference numerals designate like elements throughout.

[0032] FIG. **1** is a block view illustrating a mobile ultrasound diagnosis system according to an embodiment of the present invention.

[0033] Referring to FIG. **1**, the ultrasound diagnosis system may include a mobile ultrasound diagnosis probe device **100** and an ultrasound diagnosis apparatus **200**.

[0034] The mobile ultrasound diagnosis apparatus **100** may include a transmission signal forming unit **110**, an ultrasound probe **120** including a plurality of transducer elements, a beam former **130**, a two-dimensional array processing unit **140**, a compressing unit **150**, and a wireless communication unit **160**.

[0035] The transmission signal forming unit **110** forms a plurality of transmission signals for obtaining a frame of an ultrasonic image by considering the transducer elements and a focusing point of the ultrasound probe **120**. A frame is formed of a plurality of scan lines. Also, an ultrasonic image may include a brightness mode (B-mode) image showing a reflection coefficient of an ultrasonic echo signal as a two-dimensional image, a doppler mode (D-mode) image showing a velocity of a moving object as a doppler spectrum by using a Doppler effect, a color mode (C-mode) image showing velocities of a moving object and a scatterer as colors by using the Doppler effect, an elastic mode (E-mode) image showing a mechanical response difference of a medium between when not applying stress on an object and when applying stress on the object as an image, and a three-dimensional mode (3D-mode) image showing a reflection coefficient of an ultrasonic echo signal reflected from an object as a three-dimensional image.

[0036] The ultrasound probe **120**, as shown in FIG. **2**, converts a transmission signal provided from the transmission signal forming unit **110** into an ultrasonic signal and transmits the ultrasonic signal to an object. The ultrasound probe **120** receives an ultrasonic echo signal reflected from the object and forms a reception signal. The ultrasound probe **120** forms a plurality of reception signal by repetitively performing transmission and reception of ultrasonic signals by using a plurality of transmission signals provided from the transmission signal forming unit **110**. In this case, the ultrasonic signals transmitted and received by the ultrasound probe **120** have frame data, which are designated as ultrasonic frames. For example, an ultrasonic frame transmitted from the ultrasound probe **120** to a human body is designated as a transmission ultrasonic frame and an ultrasonic frame echoed from the human body to the ultrasound probe **120** is designated as a reception ultrasonic frame.

[0037] In the present embodiment, the ultrasound probe **120** may be embodied as a convex probe, a linear probe, a three-dimensional (3D) probe, a trapezoidal probe, and an intravascular ultrasound (IVUS) probe.

[0038] The beam former **130** analog/digital-converts a plurality of reception signals provided from the ultrasound probe **120** and generates digitalized ultrasonic data. In addition, the beam former **130** forms a plurality of digital reception focused beams by receiving and focusing the plurality of digitally converted reception signals while considering locations of transducer elements of the ultrasound probe **120** and a focus point. In the present embodiment, the beam former **130** may be embodied as a field programmable gate array or an application specific integrated circuit to improve a speed of processing the reception signals.

[0039] Digitalized ultrasonic data, as shown in FIG. **3**, is data stored to have an array form that may be shown by a brightness value in an ultrasonic image. A size of an array is determined according to the number of sampling ultrasonic waves reflected and returning from the human body. The number of arrays for one ultrasonic image may be determined according to the number of ultrasonic waves used for one ultrasonic image. In the case of using M number of ultrasonic waves for one ultrasonic image and performing N times of sampling when the respective ultrasonic waves are reflected and return from the human body, the M number of arrays having a size of N may be generated.

[0040] The two-dimensional array processing unit **140** processes ultrasonic data into two-dimensional array ultrasonic data. The two-dimensional array processing unit **140** may form a two-dimensional array **20** as shown in FIG. **4** by adjacently arranging reception ultrasonic frames echoed from the human body.

[0041] The two-dimensional array processing unit **140**, for example, may adjacently arrange the reception ultrasonic frames echoed from the human body to be perpendicular, instead of forming an image by collecting the reception ultrasonic frames echoed from the human body. The two-dimensional array processing unit **140** provides the respective reception ultrasonic frames disposed adjacently to the compressing unit **150** to compress the same.

[0042] As the reception ultrasonic frames echoed from the human body are adjacently arranged instead of being collected and forming an image, continuity of an image pattern is increased and a size of data becomes very smaller relatively to that of image data. When a size of data to be processed becomes smaller, an amount of data to be processed in a compressing process performed by the compressing unit **150** may be reduced.

[0043] FIGS. **5** to **7** are views illustrating a two-dimensional arrangement process according to an embodiment of the present invention.

[0044] Referring to FIG. **5**, the ultrasound probe **120** sequentially sends a first transmission ultrasonic frame and a second transmission ultrasonic frame to the human body. A reference numeral **10** designates transmission ultrasonic frames. In addition, the ultrasound probe **120** receives a first reception ultrasonic frame and a second reception ultrasonic frame echoed from the human body. A reference numeral **20** designates reception ultrasonic frames. The two-dimensional array processing unit **140** adjacently arranges the echoed first reception ultrasonic frame and second reception ultrasonic frame to be perpendicular.

[0045] Referring to FIG. **6**, the ultrasound probe **120** sends a third transmission ultrasonic frame to the human body. Additionally, the ultrasound probe **120** receives a third reception ultrasonic frame echoed from the human body. The two-dimensional array processing unit **140** adjacently arranges the echoed third reception ultrasonic frame to be perpendicular to the second reception ultrasonic frame.

[0046] Referring to FIG. **7**, the ultrasound probe **120** sequentially emits an Mth transmission ultrasonic frame to the human body. Additionally, the ultrasound probe **120** receives an Mth reception ultrasonic frame echoed from the human body. The two-dimensional array processing unit **140** adjacently arranges the echoed Mth reception ultrasonic frame to be perpendicular to an (M−1)th reception ultrasonic frame.

[0047] In a modified example, the beam former **130** may include a two-dimensional array processing function and may generate an array for storing initial ultrasonic data as a two-dimensional array.

[0048] In a modified example, the beam former **130** may include a two-dimensional array processing function and may generate an array for storing initial ultrasonic data as a two-dimensional array.

[0049] FIGS. **8** to **11** are views for collectively illustrating the two-dimensional arrangement process illustrated in FIGS. **5** to **7**. Referring to FIGS. **8** to **11**, the ultrasound probe **120** sequentially sends the transmission frames **10** to a human body **30** as shown in FIG. **8**. In addition, the ultrasound probe **120** receives the echoed reception ultrasonic frames **20** from the human body **30** as shown in FIG. **9**. The two-dimensional array processing unit **140** adjacently arranges the echoed reception ultrasonic frames **20** to be perpendicular and generates a two-dimensional array as shown in FIG. **10**. After that, the ultrasonic data generated as the two-dimensional array are transmitted to the ultrasound diagnosis apparatus **200** and form an ultrasonic image **30***a* for diagnosis, as shown in FIG. **11**.

[0050] When compressing ultrasonic data into a stream type in which one-dimensional arrays are continuously arranged, since a compression is performed by using only before and behind values in order, a compressibility thereof is not high, which is a reason of applying a two-dimensional array. For example, when using a one-dimensional array, a size of data may be at about 60% of an original size thereof. However, when using image-compression technology by two-dimensionally arranging by using the two-dimensional array processing unit, since all peripheral values may be used, in the case of a compression with no loss, it is possible to compress data to reduce a size at about 30% of an original size thereof. In the case of applying loss compression such as a joint photographic experts group (JPEG) method, a difference therebetween is increased. Also, ultrasonic data two-dimensionally arranged by the two-dimensional array processing unit **140** is transmitted to the ultrasound diagnosis apparatus **200** in such a way that the ultrasound diagnosis apparatus **200** may apply various image processing processes by using original ultrasound data.

[0051] The compressing unit **150** compresses ultrasonic data to be transmitted to the ultrasound diagnosis apparatus **200**. In order to efficiently use a limited band under wireless communication environments, compression is necessary. The compressing unit **150** compresses two-dimensional array data generated by the two-dimensional array processing unit **140**. Accordingly, the compressing unit **150** may increase compressibility by using image compression technology instead of data compression. The compressing unit **150** may use one of compression with no loss and compression with loss, depending on purposes and wireless communication systems.

[0052] The wireless communication unit **180** transmits data compressed by the compressing unit **150** to the ultrasound diagnosis apparatus **200**.

[0053] The wireless communication unit **180** may include short-distance wireless communications by using any one of, for example, Bluetooth, wireless USB, wireless LAN, WiFi, Zigbee, and Infrared data association (IrDA).

[0054] The ultrasound diagnosis apparatus **200** may have a wireless communication function and a display device and may include various devices for operating application programs. For example, there may be a personal computer, a smartphone, a tablet type device, a pad type device, and a personal digital assistance (PDA).

[0055] The ultrasound diagnosis apparatus **200** may be configured to include a wireless communication unit **210**, a decompressing unit **220**, a two-dimensional array processing unit **230**, a time gain compensation unit **240**, a brightness and contrast adjustment unit **250**, a control unit **260**, a display unit **270**, and a user interface unit **280**.

[0056] The wireless communication unit **210** may include short-distance wireless communications by using any one of, for example, Bluetooth, wireless USB, wireless LAN, WiFi, Zigbee, and IrDA.

[0057] The decompressing unit **220** receives ultrasonic data from the mobile ultrasound diagnosis probe device **100** via the wireless communication unit **210**.

[0058] The decompressing unit **220** obtains two-dimensional array data by decompressing the received ultrasonic data by using the same compression method used by the mobile ultrasound diagnosis probe device **100**.

[0059] The two-dimensional array processing unit **230** forms an ultrasonic image that can be displayed on a screen of the display unit **220** by using the decompressed two-dimensional array data.

[0060] The time gain compensation unit **240** compensates a time gain with respect to the ultrasonic image formed by the two-dimensional array processing unit **230**.

[0061] Since ultrasonic waves are absorbed in the human body due to properties thereof, ultrasonic waves reflected by a deep part and returning late have great losses and reduced in sizes thereof. In the same human anatomy, a size of ultrasonic data reflected by a deep part has a relatively reduced size. Accordingly, it is necessary to compensate a value increased in proportion to an amount of time for being reflected and returning. When using an ultrasonic data array having N size, a compensation value is determined by generating a time gain compensation table having the same size and then is added to an ultrasonic data array value.

[0062] The brightness and contrast adjustment unit **250** adjusts light intensity and a contrast of an ultrasonic image.

[0063] When the brightness and contrast adjustment unit **250** decreases brightness values, a brightness value of a certain degree or less is changed into 0. When the brightness and contrast adjustment unit **250** increases brightness values, a brightness value of a certain degree or more is changed into a maximum value.

[0064] Accordingly, referring to FIG. **13**, when brightness values are decreased by brightness value control operations of the brightness and contrast adjustment unit **250**, a brightness value smaller than a is changed into 0. When brightness values are increased, a brightness value greater than b is changed into a maximum value.

[0065] The brightness and contrast adjustment unit **250** controls the contrast of an ultrasonic image. When the brightness and contrast adjustment unit **250** adjusts the contrast, a contrast in a bright area having significance in an ultrasonic image may be emphasized and other areas may be one of 0 and a maximum value.

[0066] Accordingly, while the brightness and contrast adjustment unit **250** is adjusting the contrast, as shown in FIG. **14**, a contrast difference increases when a brightness value is within a range from a to b, the contrast difference is changed into 0 when the brightness value is smaller than a, and the contrast difference is changed into a maximum value when the brightness value is greater than b.

[0067] Frequently, ultrasonic data is changed into one of 0 and a maximum values due to operations of the time gain compensation unit **240** and the brightness and contrast adjustment unit **250**.

[0068] The control unit **260** generates an ultrasonic image by using two-dimensional array ultrasonic data having a compensated time gain and controlled brightness and contrast and allows the ultrasonic image to be displayed on the display unit **270**.

[0069] In this case, the control unit **260** determines a size of the ultrasonic data by considering a size of the screen of the display unit **270**.

[0070] The control unit **260** may determine an ultrasonic wave measurement depth according to an input of a user, may determine a parameter used by the time gain compensation unit **240** based on the ultrasonic wave measurement depth, and a degree of adjustment of the brightness and contrast adjustment unit **250**.

[0071] The control unit **260** may receive the input of the user via the user interface unit **280** and may transmit the input to the ultrasound diagnosis probe device **100** by using wireless communications. For example, the control unit **260** may transmit the ultrasonic wave measurement depth determined to control the mobile ultrasound diagnosis probe device **100** to the mobile ultrasound diagnosis probe device **100**.

[0072] The control unit **260** may automatically measure a wireless communication environment and may determine sizes of transmission data. The control unit **260** transmits dummy data having a certain size to the mobile ultrasound diagnosis probe device **100**.

[0073] Accordingly, the wireless communication unit **160** of the mobile ultrasound diagnosis probe device **100** receives the dummy data from the ultrasound diagnosis apparatus **200** and then calculates an available band of presently used wireless communication by measuring an amount of time for receiving the dummy data.

[0074] The wireless communication unit **160** of the mobile ultrasound diagnosis probe device **100** determines a size of data to be wirelessly transmitted according to an available band. The smaller a band is, the more reduced a rate of a frame to be transmitted is.

[0075] While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. Therefore, the scope of the invention is defined not by the detailed description of the invention but by the appended claims, and all differences within the scope will be construed as being included in the present invention.

1. A mobile ultrasound diagnosis system comprising:

a mobile ultrasound diagnosis probe device, being portable, digitally processing ultrasonic data obtained from an object, processing digitalized ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame, and wirelessly transmitting the two-dimensional array ultrasonic data; and

an ultrasound diagnosis apparatus receiving the two-dimensional array ultrasonic data from the mobile ultrasound diagnosis probe device, decompressing and restoring the two-dimensional array ultrasonic data, and generating ultrasonic image data by compensating a time gain and adjusting brightness and a contrast of the two-dimensional array ultrasonic data.

2. The mobile ultrasound diagnosis system of claim **1**, wherein the mobile ultrasound diagnosis probe device processes reception ultrasonic frames of a series stream into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame unit to be perpendicular.

3. The mobile ultrasound diagnosis system of claim **1**, wherein the ultrasound diagnosis apparatus determines an ultrasonic wave measurement depth according to an input of a user and determines a parameter for compensating a time gain and parameters for adjusting the brightness and the contrast, based on the ultrasonic wave measurement depth.

4. The mobile ultrasound diagnosis system of claim **1**, wherein the ultrasound diagnosis apparatus transmits dummy data for automatically measuring a wireless communication environment and determining sizes of transmission data to the mobile ultrasound diagnosis probe device, and

wherein the mobile ultrasound diagnosis probe device receives the dummy data from the ultrasound diagnosis apparatus, calculates an available band of presently used wireless communication by measuring an amount of time for receiving the dummy data, and determines sizes of data to be wirelessly transmitted according to the available band.

5. A mobile ultrasound diagnosis probe device comprising:

a transmission signal forming unit forming a transmission signal for obtaining a frame of an ultrasonic image;

an ultrasound probe converting the transmission signal of the transmission signal forming unit into an ultrasonic signal, transmitting the ultrasonic signal to an object, and obtaining analog ultrasonic data reflected from the object;

a two-dimensional array processing unit processing the obtained analog ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame;

a compressing unit compressing the two-dimensional array ultrasonic data adjacently arranged for each ultrasonic frame; and

a wireless communication unit wirelessly transmitting compressed two-dimensional array ultrasonic data to an ultrasound diagnosis apparatus.

6. The mobile ultrasound diagnosis probe device of claim **5**, wherein the two-dimensional array processing unit processes reception ultrasonic frames of a series stream into two-dimensional array ultrasonic data by adjacently arranging for each frame unit to be perpendicular.

7. The mobile ultrasound diagnosis probe device of claim **5**, further comprising a beam former generating digitalized ultrasonic data from the analog ultrasonic data obtained from the ultrasound probe.

8. The mobile ultrasound diagnosis probe device of claim **7**, wherein the beam former generates M number of arrays having N size when using the M number of ultrasonic waves for one ultrasonic image frame and performing N times of sampling when the respective ultrasonic waves are reflected and return from the object.

9. The mobile ultrasound diagnosis probe device of claim **5**, wherein the two-dimensional array processing unit generates two-dimensional array data having N×M arrays in the case of using M number of ultrasonic waves for one ultrasonic image frame and performing N times of sampling when the respective ultrasonic waves are reflected and return from the object.

10. The mobile ultrasound diagnosis probe device of claim **5**, wherein the wireless communication unit comprises short-distance wireless communications by using any one of Bluetooth, wireless USB, wireless LAN, WiFi, Zigbee, and Infrared data association (IrDA).

11. An ultrasound diagnosis apparatus comprising:

a decompressing unit wirelessly receiving compressed ultrasonic data from a mobile ultrasound diagnosis probe device and decompressing the ultrasonic data by using the same method as a compression method used by the mobile ultrasound diagnosis probe device;

a two-dimensional array processing unit processing the decompressed ultrasonic data into two-dimensional array ultrasonic data by adjacently arranging for each ultrasonic frame;

a time gain compensation unit compensating a time gain with respect to the two-dimensional array ultrasonic data;

a brightness and contrast adjustment unit adjusting brightness and a contrast with respect to the two-dimensional array ultrasonic data; and

a control unit generating an ultrasonic image for diagnosis by using two-dimensional array ultrasonic data having a compensated time gain and adjusted brightness and contrast.

12. The ultrasound diagnosis apparatus of claim **11**, wherein the time gain compensation unit compensates ultrasonic data according to a time gain compensation table.

13. The ultrasound diagnosis apparatus of claim **11**, wherein the brightness and contrast adjustment unit changes a brightness value of a certain value or less into 0 and changes a brightness value of a certain value or more into a maximum value.

14. The ultrasound diagnosis apparatus of claim **11**, wherein the brightness and contrast adjustment unit changes a contrast value of a certain value or less into 0 and changes a contrast value of a certain value or more into a maximum value.

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专利名称(译)	基于二维阵列数据的移动超声诊断系统及移动超声诊断探针装置及系统超声诊断装置		
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摘要(译)

提供一种移动超声诊断系统，包括移动式超声诊断探测装置，可移动，数字处理从物体获得的超声数据，通过相邻地布置每个超声帧将数字化超声数据处理成二维阵列超声数据，并且无线传输二维阵列超声数据和超声诊断装置接收来自移动超声诊断探测装置的二维阵列超声数据，解压缩和恢复二维阵列超声数据，并通过补偿时间增益和调整产生超声图像数据亮度和二维阵列超声数据的对比度。